Questioning Aristotle: Roger Bacon on the True Essence of Colour

by Yael Raizman-Kedar

1. Introduction

The first Latin version of Aristotle`s *De sensu et sensato* dates from the second half of the twelfth century. One of the pioneers addressing its interpretation was Roger Bacon (1220–1292), who lectured in the 1240s in Paris on several of Aristotle's works. The questions on the *De sensu* belongs to the so called "early period" of Bacon's work, a period prior to his crucial encounter with the teachings of Robert Grosseteste (1168–1253). This encounter had supposedly turned Bacon's mind towards experimental science, mathematics, and the pursuit of a new universal science, involving a radical reorganization of Christian learning, and resulting in the writing of the *Opus majus* and *De multiplicatione specierum* – his most well-known works.

The inclusion of the *De sensu* into Bacon's early period may explain why it received but little attention in contemporary scholarship. I was able to find only one paper addressed to Bacon's theory of colour as presented in his questions on the *De sensu*. This paper, written by Charles Parkhurst,[1] is concerned with Bacon's collocation of colours. It indicates Bacon's innovative colour theory and its far-reaching influence upon the art of painting. According to Parkhurst, Bacon had opened new ways of organizing colours for useful ends and influenced medieval and renaissance painters and theorists such as Giotto, Alberti, Rubens, Da Vinci, and Ficino.[2] One interesting observation by Parkhurst is that Bacon had revised this text and made several additions to it after his return to Oxford from Paris. The influence of Grosseteste is therefore well manifested in the text, and Parkhurst concludes: "I think no more need be said of Bacon's great

[1] Charles Parkhurst, "Roger Bacon on Color: Sources, Theories and Influence," ed. K.L. Selig and E. Sears, *The Verbal and the Visual: Essays in honor of Willian Sebastian Hechscher* (New York, 1990), pp. 151–202.

[2] Pankhurst, "Roger Bacon on Color," p. 152.

indebtedness to Grosseteste. He takes it all. But, indeed, he develops it 'in particular.'"[3]

While I agree with Parkhurst that Grosseteste's influence is apparent in the text, I argue that at least with regard to the question of the nature and essence of colour, that influence was mainly negative. Bacon developed his own views on the subject, and these differed in significant ways from those held by Grosseteste.

In this paper, I address two topics concerning Bacon's *Quaestiones supra librum de sensu et sensato*: (1) His view of the nature and essence of colour; and (2) the method he used to stress that his distinctive position does not, in fact, exhibit a departure from some great authorities.

2. Aristotle, Alhacen, Avicenna, and Grosseteste on Colour

In order to assess Bacon's originality, let us review some of the accounts he had at hand, starting with Aristotle. In the second part of the *De anima*, Aristotle established the principle that each sense can perceive with full certitude only a limited set of objects, namely its proper sensibles. The proper sensible of hearing was sound, that of taste was flavour, that of vision was the visible. According to Aristotle the visible was a class comprising two members: colour and something else that had no name: "The object of sight is the visible, and what is visible is colour and a certain kind of object which can be described in words but which has no single name."[4]

Light, according to Aristotle's definition, is the intervening medium (*diaphanous*) when it is in an actual state of transparency.[5] The medium, which is only potentially transparent in the dark, becomes actually transparent when a fiery element is present within or above it. Light is indeed a necessary precondition for the visibility of colour, but it is not visible in itself. Light is not considered a visible object by Aristotle, since as a state of the transparent medium we either see through it, or see it through the colour of something else.[6] These principles laid down in the *De anima* receive further consideration in the *De sensu*. There, Aristotle stated concerning transparency that it "is not something peculiar to air, or water, or any other of the bodies usually called translucent, but is a common nature and power, capable of no separate existence of its own, but residing in these,

[3] Pankhurst, "Roger Bacon on Color," p. 172.
[4] Aristotle, *De anima* 2.7, 418a, 26–27, trans. H. Lawson-Tancred (London, 1986), p. 173.
[5] Aristotle, *De anima* 2.7, 418b, 9–10; 14–20, Lawson-Tancred, p. 174.
[6] Aristotle, *De anima* 2.7, 418b, 4–6, Lawson-Tancred, p. 174.

and subsisting likewise in all other bodies in a greater or lesser degree."[7] The *diaphanous*, or the transparent nature is what causes bodies to partake in colour, and since it is present in all bodies, all bodies have colour. This transparent nature is a potential in need of actualization. When unrestricted it is actualized as light; when restricted within defined boundaries, it is actualized as colour.[8] Thus according to Aristotle light is itself a sort of colour, the colour of the transparent medium,[9] while colour is a well-bounded light.

Now, how do the different colours arise out of transparency? The Aristotelian answer would be that the colours vary according to the amount of the transparent nature within each delimited body. The colours can all be arranged on a scale from white to black, those closer to white are the ones with the greater concentration of transparent nature, while those closer to black are those lacking that nature almost completely: "Now, that which when present in air produces light may be present also in the Transparent; or again, it may not be present, but there may be a privation of it. Accordingly, as in the case of air the one condition is light, the other darkness, in the same way the colours white and black are generated in determinate bodies."[10]

The Muslim thinkers generally accepted Aristotele's account of colour as formed by different proportions of white and black. They did, however, challenge Aristotle's definition of light as well as his assertion that light is not visible in itself. For instance, the first four sections in Alhacen's (965–1040) book *De aspectibus* are nothing but a recital of evidence that light is directly perceived by our eyes, leading to the conclusion that both light and colour affect sight: that is, both light and colour should be considered as proper sensibles of sight.[11]

Avicenna (980–1037) thought of light as a quality of a luminous body rather than as a state of the transparent medium.[12] The actualization of the medium is no longer considered by him as identical with light, but as its *effect.*[13] Avicenna drew the distinction between light as a natural quality of a

[7] Aristotle, *Sense and Sensibilia* 1.3, 439a, 21–25, ed. Jonathan Barnes, *The Complete Works of Aristotle – The Revised Oxford Translation* (Princeton, 1984), p. 697.

[8] Aristotle, *Sense and Sensibilia* 1.3, 439a, 26–30, in Barnes, p. 697.

[9] Aristotle, *De anima* 2.7, 418b, 11–12, Lawson-Tancred, p. 174; *Sense and Sensibilia* 1.3, 439a 18–19, in Barnes, p. 697.

[10] Aristotle, *Sense and Sensibilia* 1.3, 439b 15–18, in Barnes, p. 698..

[11] Alhacen, *De aspectibus* 1.1.4.1–7, ed. and trans. A. Mark Smith, *Alhacen's Theory of Visual Perception*, vol. 2 (Philadelphia, 2001), pp. 343–44.

[12] D.N. Hasse, *Avicenna's De Anima in the Latin West* (London, 2000), p. 116.

[13] Hasse, *Avicenna's De Anima*, p. 113.

self-luminous body (*lux*), and light as an acquired quality of a body (*lumen*). He emphasized that only a body with acquired light has colours that can be seen.[14] He therefore associated colour with *lumen* alone, stating that where there is *lux*, there would be no colour.

Light as *lux* was thus given a firmer ontological status, rather than that of a mere state of transparency. That new status was embraced by Grosseteste, who replaced transparency with *lux* as the basis of colour. In the *De colore* he defined colour as "*lux* incorporated within transparency,"[15] and in the *De operatione solis* he further explained that "all colours have in their substance something of the sun's *lux*."[16] According to Grosseteste, however, the active nature of the *lux* inside a tangible body is restrained by matter, and only when the external *lux* unites itself with the *lux* inside the body, that it is activated and able to consume its visibility.

Grosseteste explained that the kinds of colour produced depend on the nature of the extrinsic *lux*: it can be clear or obscure, concentrated or diffused. The nature of the transparent medium surrounding the body in which *lux* is incorporated also has a part in creating the different colours: it can be either pure or impure. When the external *lux* is very clear, and shines in pure transparency, the white colour is formed; but when *lux* is diffused and the transparent medium is impure, then the black (or the bluish) colour appears.[17] Colour can also be formed without association to matter, such as in the case of the rainbow. The determining factor being the quantity of the rays of *lumen*, concentrated in one place, and dispersed in another.[18] Just like Aristotle, Grosseteste thought that all the other colours are stretched between white and black, and that their variations are due to the different combinations between the above-mentioned three factors.[19]

Bacon's account of colour is different from both Aristotle's and Grosseteste's. He makes two points:

(1) He rejects Aristotle's contention that colour was the sole proper object of vision. He also rejects the view that both light (*lux*) and

[14] Hasse, *Avicenna's De Anima*, p. 112.

[15] Robert Grosseteste, *De colore*, ed. Ludwig Baur, *Die Philosophischen Werke des Robert Grosseteste, Bischofs von Lincoln* (Münster, 1912), p. 78.

[16] Grosseteste, *De operatione solis* 6, ed. James McEvoy, *The Sun as res and signum: Grosseteste's Commentary on Ecclesiasticus ch. 43, vv. 1–5*. Recherches de Théologie ancienne et médiévale 41 (Louvain, 1974), pp. 69–70.

[17] Grosseteste, *De operatione solis* 17, in McEvoy, *The Sun*, p. 78.

[18] A.C. Crombie, *Robert Grosseteste – and the Origins of Experimental Science 1100–1700* (Oxford, ([1953]/1971), p. 127.

[19] Grosseteste, *De colore*, in Baur, *Die Philosophischen Werke*, p. 79.

> colour is the proper objects of vision, as Alhacen had proposed. Instead, he posits a third entity as the ultimate visible nature, one which has no name. That third party is a genus of which both light and colour are species.
> (2) He argues that neither the transparent medium nor light has to do with the definition and essence of colour. The cause generating colour is not *lux*, but the qualities of the elements, which are either intensified (*intenduntur*) or abated (*remittuntur*) through the power of *lumen*.[20] Light indeed plays an active role in bringing out the qualities of the elements, yet once that is done; it is no longer present at the scene.

Bacon presents a wealth of arguments to support his contention, of which I shall present but a few examples. I will then move on to consider where exactly, in Bacon's view, lies his predecessor's mistake. It is not only the idiosyncrasy in Bacon's account of colour that I wish to stress in this paper, but indeed its manner of justification. This manner consists of reducing all disagreements to the level of terminology. Aristotle and his interpreters, so Bacon states, do not use names properly: they transfer the name of one of the components to the whole composition, the name of the genus to one of its species, and the name of the similitude to that which is similitude of. The disagreements concerning the nature of colour, so Bacon seems to conclude, could all be resolved once a concurrence regarding terms is established.

3. Bacon's Arguments against the Dominant Theories of Colour

I begin with Bacon's arguments concerning the proper object of vision.

Bacon inquires why Aristotle assigned colour rather than *lux* as the proper object of vision. His answer is that by contrast to all proper sensibles, Aristotle believed that *lux* is a cause (*efficiens*) with respect to colour. Another reason being that *lux* in its purity cannot be seen by the eye.[21] Colour, according to Aristotle, agrees much more than *lux* with the other proper sensibles, all of which can be perceived by a sense directly even if pure, and cannot be considered as causes of that which is perceived.

In order to contradict this outlook, Bacon finds it necessary to clarify the nature of *lux*. He first evokes Avicenna's definition of *lux* as an accidental

[20] Roger Bacon, *Quaestiones supra librum de sensu et sensato* 12, ed. R. Steele, *Opera hactenus inedita*, vol. 14 (Oxford, 1905–1940), p. 51: "Cause generantes colores sunt qualitates elementares que intenduntur et remittuntur in generationibus suis per virtutem luminis."

[21] Bacon, *Quaestiones supra librum de sensu* 8, in *OHI* 14, p. 26.

quality of a luminous body, belonging to the third kind of qualities (according to Arisotle's *Categories*).[22] Then he argues that the term *lux* is wrongly used in two ways, in both of them its meaning is extended far beyond its proper application. In some cases *lux* is used to denote that which multiplies and diffuses itself outwards from a luminous body. Yet that which is multiplied from a luminous body should accurately be called *lumen*. Indeed, it is *lumen* – not *lux* – which is the active agent in the transformation of colour. It often happens that the similitude is led back to that of which it is similitude. In this specific case, *lumen* – which is the similitude of *lux* – is led back to *lux* so that they are considered to be of the exact same essence. The term *lumen* however, is also erroneously used according to Bacon, since its meaning is extended to all that is multiplied out of any substantial nature, rather than to what is multiplied from *lux* alone.[23] Once again, Bacon stresses, not all that is multiplied from another is *lumen*. In other cases, so Bacon proceeds, the term *lux* is improperly employed to denote substantial (note: not accidental) forms of several kinds, such as those of the heavens and the stars or those of the elements. This is, in my view, an allusion to Grosseteste's metaphysics of light. In the *De luce* Grosseteste wrote about the first point of *lux*, from which the material universe was created. He defined that first *lux* as a substantial form, as the form of corporeity, and as the form of the luminaries.[24] According to Bacon, however, *lux* is neither a substance nor a substantial form, and therefore he considers Grosseteste's use of the term as philosophically inaccurate. His use is misleading because according to Bacon the effects of both colours and the elements are not made by *lux*, but rather by substantial powers, *lux* not being one of them. *Lux* can only be considered a cause of inferior things by the fallacy of an inadequate extension of meaning. He writes: "Not all the effects of colour or of the elements are made by *lux* this way, but by substantial powers (*virtutibus*), and the name of *lux* is transferred to designate these powers, because these are unknown to us, while *lux* is the most evident."[25]

[22] See Aristotle, *Categories* 8, 9a1–9b1, in Barnes, vol.1, p. 15. The third group of qualities consists of affective qualities, which are so called because they cause affection of the senses.

[23] Bacon, *Quaestiones supra librum de sensu* 8, in *OHI* 14, p. 27: "Hoc nomen 'lumen' transsumitur ad totum illud aggregatum et ad illud quod ex parte nature substantialis multiplicatur."

[24] Grosseteste, *On the Six Days of Creation* 5.4.1, trans. C.F.J. Martin, *On the six Days of Creation – a Translation of the Hexaemeron* (Oxford, 1996), p. 161.

[25] Bacon, *Quaestiones supra librum de sensu* 12, in *OHI* 14, pp. 47–48: "Non omnes effectus colorum nec etiam elementorum fiunt a luce hac, set a virtutibus substantialibus, ut

In order to correct the fallacy of using terms such as *lux* and *lumen* ambiguously, Bacon suggests the use of a different set of terms for that which is producing and multiplying, and for the outcome of such multiplication. For the one producing he suggests the term "agent," and for its impression upon a patient he proposes "species." For the specific case of light, the producing agent should be named *lux*, while its product or "species" should rightly be called *lumen*. However, these should be used only when the action of light is at stake.

This strategy of concentrating on terminological rather than philosophical issues involves some tricks on Bacon's part. He ignores Grosseteste's clear philosophical standpoint, according to which *lux* is not recklessly treated as a substance, but rather *defined* as such. Nevertheless, Bacon's message is clear cut, and directly opposed to Grosseteste's way of thinking: if one wants to accurately understand the nature of colour, one should stop using light metaphors. More importantly: one should stop using these metaphors as the starting point for his account. The nature of light and colour should be dealt with on the basis of their actual conduct, not on the basis of other phenomena which they illustrate.

Now I approach Bacon's second dispute with his predecessors: the essence of colour. Bacon accepts Alhacen's inclusion of transparency among the common sensibles, which are not perceived directly in the same way as the proper sensibles, but rather deduced from direct perception by a swift process of inference.[26] This assertion is enough, in Bacon's view, to exclude transparency from the essence of colour.[27] For if colour is a proper sensible and transparency a common one, they cannot be one and the same. Transparency does not move vision, so Bacon concludes: "vision is carried

patet alibi, ad quas virtutes substantiales designandas transumunt nomen lucis eo quod sunt nobis ignote, et lux est nobis manifestissima."

[26] Bacon, *Quaestiones supra librum de sensu* 11, in *OHI* 14, p. 37: "perspicuum autem non est hujusmodi neque cognoscitur a visu nisi per distinctionem et argumentationem videtur quod non poterit esse essential coloris." For the details of Alhacen's theory of visual perception, see Abdelhamid I. Sabra, "Sensation and Inference in Alhacen's Theory of Visual Perception," in *Studies in Perception*, ed. Peter Machamer and Robert Turnbull (Columbus: Ohio State, 1978), pp. 160–85.

[27] Bacon, *Quaestiones supra librum de sensu* 11, in *OHI* 14, p. 36: "Et quia perspicuum est sensibile commune, planum est quod non cadit in essentiam coloris."

off over the species of colour as over an object which is naturally and of itself born to move vision, while transparency is not such…."[28]

Bacon is in pains to explain why Averroes (1126–1198) agrees with Aristotle on this point, stating that colours are composed out of the complementary natures of transparency and brightness. Once again, he points to the fallacy of ambiguous use of language: Averroes did not mean to say that transparency enters the essence of colour. What he meant was that colour is formed out of the union of a certain unspecific entity with transparency. Therefore, he meant that colour was transparency or brightness *before* it became colour, that is, before transparency and that unspecified entity became united. In this case Averroes commits the fallacy of transferring the name of one component to the name of the whole composition, and therefore does not speak properly.[29]

The response for the Aristotelian thesis, that the difference between coloured and uncoloured objects is a determinate boundary, is given by Bacon in terms of experience. Some liquids, such as wine and blood, which have no defined boundary have distinct colours, while some well-restricted solids such as crystals and ice have no colour. A defined boundary, so Bacon concludes, is extraneous to the essence of colour.[30] The Aristotelian precept that "colour is the outline of the transparent" (*color est extremitas perspicui*), is accurate not because transparency belongs to the colour's essence, or because having a boundary is essential to colour, but because this outline is made out of conditions antithetical to transparency. That is, when fineness and thinness are diminished by thickness, purity by impurity, and expansion by density. It is only by these conditions that transparency becomes apt to the generation of colour.[31]

Many thinkers have tried to substitute the place given to transparency in the Aristotelian account with *lux*. Bacon describes how *omnes dicunt* that colour is the bounded *lux* placed in transparency. That is, it is not the case that transparency is the substance or essence of colour, but rather *lux*. Bacon refers to Averroes as saying that it is according to the strength and weakness of *lux* that the different colours are produced.[32] If we follow this logic, so Bacon contends, then, since the natures of *lux* and colour are the same, and

[28] Bacon, *Quaestiones supra librum de sensu* 11, in *OHI* 14, p. 37: "Visus enim fertur super species colorum sicut super objectum quod est natum inmutare visum naturaliter et per se, perspicuum vero non est tale…"

[29] Ibid.

[30] Bacon, *Quaestiones supra librum de sensu* 11, in *OHI* 14, pp. 38–39.

[31] Ibid.

[32] Bacon, *Quaestiones supra librum de sensu* 12, in *OHI* 14, p. 44.

since both move vision in and of themselves, they can be reduced one to the other. And since colour is not seen without *lux*, it is the nature of *lux* which is more inherently visible, and therefore it is the nature of colour that should be reduced to the nature of *lux*.[33]

Bacon's next undertaking is to demonstrate that *lux* too, just like transparency, is to be excluded from the essence of colour. He asks: can it be that the one and the same thing is called *lux* when it is without a boundary and colour once it becomes delimited? If this were the case, then the difference between *lux* and colour would be accidental, yet their essence would be the same. Had this been true, then wherever there would be colour there would also be *lux* and vice versa, which is clearly false.[34] However, it could be that colour is a combination of *lux* with some other thing. If *lux* is a component of colour, then it can be either its matter or its form, but since *lux* is not matter in the first place, it can only be the colour's form.[35] In this case *lux* would be a general, common form of all the specific colours. It follows that there will not be *lux* where colour is absent, because the completive form of a thing cannot be found where that thing is gone. Yet *lux* is in fire, where there is no colour.[36] When *lux* is complete and fully actual (*in actu*), it is not colour, as is seen in fire and stars. When it is short of completion, then *lux* and colour seem to exist simultaneously, as in a rotten Oak tree, the neck of a dove, scales of a fish, and similar things, and the greater the intensity of *lux* the more colour is diminished, and vice versa. Therefore in pure colour there will be no *lux*.[37]

4. Bacon's Positive Account

I now turn to what may be called Bacon's positive account. After rejecting the dominant theories, he presents what he believes in. Bacon asserts that *lux* is a *species specialissima*,[38] and that all *species specialissima* have, as a corresponding equivalent, another *species specialissima*. For instance, the class "rational animal" has the equivalent class "irrational animal" among

[33] Bacon, *Quaestiones supra librum de sensu* 12, in *OHI* 14, p. 45.

[34] Bacon, *Quaestiones supra librum de sensu* 11, in *OHI* 14, p. 40.

[35] In *Quaestiones supra librum de sensu* 12, in *OHI* 14, p. 56, Bacon writes that *lux* is not matter but that it is somehow attached to its matter and enclosed in it ("set lux est quoddam annexum materie isti et materie incluse").

[36] Bacon, *Quaestiones supra librum de sensu* 12, in *OHI* 14, pp. 41–42.

[37] Bacon, *Quaestiones supra librum de sensu* 12, in *OHI* 14, p. 44.

[38] A *species specialissima* is "the most specific species", namely, a group that cannot be divided further by any specific differences, for the individuals contained in the group are essentially the same.

the animals. Now, given that *lux* is a *species specialissima*, what could its corresponding equivalent be? Bacon's answer is that colour is the counterpart of *lux*. Colour deserves to be so, since it is a visible nature just like *lux*, and therefore they should be considered as two species of one and same genus. That genus, whatever it may be and although it has no proper name, is the first visible nature and the proper sensible of sight.[39] Since it has not been endowed with a proper name, that genus, which comprises both *lux* and colour, will be called for now *esse visibile*. However, it is sometimes wrongly called *lux*.

With this idea at hand, Bacon addresses the misunderstanding displayed by those who consider *lux* to be the substance of colour. Again he regards it a case of a confused terminology. *Lux* is in some cases supposed as a name of the species, yet in other cases as a name of the genus. This confusion results from the similarity between the genus and the species, as well as from deficient vocabulary. Since *lux* as species participates more than colour in the nature of their common genus, the name of *lux* is transferred to the designation of this common nature.[40] There is yet another reason for this confusion: colour cannot be seen without *lux* while *lux* can better be seen without colour, therefore the visible nature seems to be radically and originally in *lux*. According to Bacon however, this is not the case, and the source of visibility is not in *lux*, but in a nature which is common to *lux* and colour. It is only due to the above-mentioned erroneous manner of speech, that the cause of visibility is attributed solely to *lux*.[41]

It follows that *lux* can be said to be the substance of colour only when referred to as genus. *Lux* can be understood as the substance of colour only in the sense that an animal can be said to be made of semen, that is, by a substantial change in which the specific form of *lux* is totally destroyed,[42] or as the forms of the elements are with relation to the substance of the mixture and as numbers proceed with respect to sequence.[43] It is only according to this manner of speech that colour can be said to be made out of *lux*.[44]

[39] Bacon, *Quaestiones supra librum de sensu* 12, in *OHI* 14, p. 48.

[40] Bacon, *Quaestiones supra librum de sensu* 12, in *OHI* 14, p. 49.

[41] Ibid.

[42] Bacon, *Quaestiones supra librum de sensu* 12, in *OHI* 14, p. 51.

[43] Ibid. To those who find it hard to accept this claim, Bacon offers a softer version: the nature of *lux* does exert the visible nature into colour, yet just as the forms of the elements in a mixture do not remain in their full actuality, but are so diminished that they are as if half way between potentiality and action. In this way the transformation of *lux* into colour is its end, which is yet not a full corruption, but a bit below that.

[44] Ibid.

If neither from transparency, nor from *lux*, what is it then, that from which colour is born? Bacon's answer is this: colours are created by a mixing of the elements and by the action of their qualities. The function of *lux* is to excite the active power in matter. When a ray of light falls upon a cloud, the colours of the rainbow are made not only from its union with *lux* but from *lux* exciting the powers within the cloud, which is composed of the four elements. The powers of fire and *lux* change the other elements, and it is in this way that the natural generation of colour occurs in the rainbow. Bacon stresses that the clear patch of *lumen* which appears over a cloud is not colour. It can be called white if the cloud is transparent and black if the cloud is thick, but it is called so only equivocally.[45] Clarity and obscurity of *lux* cannot rightly be called colours.[46] The mere union of *lux* with the transparent medium is not enough to create colour, and the range of colours is not a product of different levels of clarity and obscurity or of the different ratios of white and black. The principles of colour are the qualities of the elements, such as transparency, humidity, dryness, heat, and coldness.[47] The colours therefore cannot be lined up from white to black. Instead, there are five principal colours that are "distinct by nature," and from which all the other colours are produced by way of mixtures.[48]

5. Conclusions

As Parkhurst declared, Bacon's account of colour was indeed novel. However, Bacon could not have broken out from Aristotle's arrangement of colours as linearly stretched between white and black, had he not reviewed the essence of colour beforehand, and had he not defined it anew. It is only by binding colour with matter and with the four elements, that the duality of white and black could have been overpowered. This is very different from Grosseteste, who thought that colours can be produced solely by the encounter of light with transparency, and who considered the variances of colour as due solely to factors related to light and to the state of the transparent medium. Just the same, there is a fair chance that Bacon would not have reviewed the nature of colour in the way he did had he not carried the torch of language.

[45] Bacon, *Quaestiones supra librum de sensu* 13, in *OHI* 14, p. 60.

[46] Bacon, *Quaestiones supra librum de sensu* 14, in *OHI* 14, p. 61.

[47] Ibid.

[48] Bacon, *Opus majus* 5.12, trans. Robert Belle Burke, *The Opus Majus of Roger Bacon* (Philadelphia, 1928), vol. 2, p. 611.

One way in which Bacon expressed his concern for accurate terminology was his rather aggressive attack on the Latin translations of his time: "For so great is the perverseness, crudity, and terrible difficulty in the translated works of Aristotle that no one can understand them, but each one contradicts another, and false statements are found again and again..."[49] As Bacon saw it, one of the tasks involved in the foundation of a new universal science he had undertaken upon himself was establishing a new and unified scientific vocabulary. It is within this context that Bacon's account of colour and his method of interpretation should be viewed.

Yael Raizman-Kedar, The University of Haifa

[49] Bacon, *Opus majus* 3.1, in Burke, p. 77.